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Lieut.-General J. F. TENNANT, C.I.E., R.E., F.R.S., President, in the Chair.

Thomas Steele Sheldon, M.B.Lond., Parkside, Macclesfield, was balloted for and duly elected a Fellow of the Society.

The following candidate was proposed for election as a Fellow of the Society, the name of the proposer from personal knowledge being appended :—

Rev. John Mitchell, B.D., 57 Parkgate Road, Chester (proposed by John Hartnup).

The following were proposed by the Council as Associates of the Society :—

Lewis Boss, Dudley Observatory, Albany, N.Y., U.S.A.;
A. Cornu, Paris;
C. Souillart, Lille, France.

Comparison of the Right Ascensions of Clock Stars in the Greenwich Ten-Year Catalogue for 1880 *with the Fundamental Catalogues of the American Ephemeris and of the Astronomische Gesellschaft.* By Professor Simon Newcomb.

The fundamental catalogues with which this comparison is made are found in the following three publications :—

(*a*) *Catalogue of* 1098 *Standard Clock and Zodiacal Stars; Astronomical Papers of the American Ephemeris*, vol. i.

(*b*) *Fundamental-Catalog für die Zonen-Beobachtungen am nordlichen Himmel. Herausgegeben im Auftrage der Zonen-Com-*

mission der Astronomischen Gesellschaft, von A. Auwers. Pub. XIV. *der Astronomischen Gesellschaft.*

(*c*) *Vorläufiger Fundamental-Catalog für die südlichen Zonen der Astronomischen Gesellschaft.* Von A. Auwers. *Ast. Nachr.* No. 2890, vol. cxxi. p. 145.

I have ignored the preliminary fundamental catalogue given in Publication XVII., *Astronomische Gesellschaft*, supposing it to be superseded by the last catalogue (*c*) just quoted. And I have devoted a separate column to the latter because it gives revised positions of a few stars of (*b*).

The latest Greenwich observations employed in these fundamental catalogues were those for the year 1876. Such at least is the case for the first two, and I infer the same to be true of the last, because later Greenwich observations are not mentioned in the list of authorities on which it rests. The observations on which the Ten-Year Catalogue was formed began in 1877, so that its results are quite independent of the catalogues compared. Some interest may therefore attach to a comparison of the authorities, as affording an index to the degree of precision attained in the right ascension of fundamental stars, and suggesting special points to be attended to in still further improving these right ascensions. In the following exhibit the second column contains the right ascensions, given on pp. 56 and 57 of the Ten-Year Catalogue, as based on 12-hour groups. The three following columns (*a*, *b*, *c*) contain the decimals of the seconds of right ascension from the three fundamental catalogues, taken in order. In each case the positions for 1880·0 have been derived from those of the catalogue by using the values of the proper motions given therein.

The three following columns contain the apparent corrections in right ascension given by the Greenwich results :—

Name of Star.	Right Ascensions for 1880·0. Ten-Year Cat.	(*a*)	(*b*)	(*c*)	App. Corrections. (*a*)	(*b*)	(*c*)
	h m s	s					
α Androm.	0 2 11·186	·210	202	...	−24	−16	...
γ Pegasi	0 7 3·408	·455	·449	...	−47	−41	...
ι Ceti	0 13 18·801	...	·812	·804	...	−11	− 3
44 Piscium	0 19 15·070	·079	...	...	− 9	...	...
12 Ceti	0 23 54·846	·878	...	·894	−32	...	−48
ε Androm.	0 32 12·961	...	·993	...	...	−32	...
β Ceti	0 37 33·904	·947	...	·918	−43	...	−14
δ Piscium	0 42 27·397	·419	...	...	−22	...	...
20 Ceti	0 46 52·483	·483	...	...	0	...	...
μ Androm.	0 50 5·711	...	·826	...	...	−115	...
ε Piscium	0 56 42·932	·952	·956	...	−20	−24	...
β Androm.	1 3 0·932	·996	·001	...	−64	−69	...
ζ¹ Piscium	1 7 27 711	·717	...	...	− 6	...	...

Name of Star.	Right Ascensions for 1880·0. Ten-Year Cat.	(a)	(b)	(c)	App. Corrections. (a)	(b)	(c)
	h m s	s					
θ Ceti	1 18 1·479	·519	·544	·532	−40	−65	−53
η Piscium	1 25 3·758	·805	·796	...	−47	−38	...
ν Piscium	1 35 11·195	·234	...	·216	−39	...	−21
ο Piscium	1 39 3·432	·477	·456	...	−45	−24	...
β Arietis	1 48 0·727	·762	·760	...	−35	−33	...
α Arietis	2 0 24·611	·646	·640	...	−35	−29	...
ξ^1 Ceti	2 6 38·408	·452	...	...	−44	...	...
67 Ceti	2 10 59·876	...	...	·901	...	...	−25
ξ^2 Ceti	2 21 46·754	·806	·787	...	−52	−33	...
ν Ceti	2 29 34·633	...	...	...	...	...	...
δ Ceti	2 33 19·903	...	·951	·926	...	−48	−23
γ^2 Ceti	2 37 4·961	·998	·002	...	−37	−41	...
σ Arietis	2 44 52·081	·122	...	...	−41	...	...
ε Arietis	2 52 21·081	·126	...	...	−45	...	...
α Ceti	2 56 0·412	·440	·420	·424	−28	− 8	−12
δ Arietis	3 4 46·086	·113	...	...	−27	...	...
τ^1 Arietis	3 14 18·005	·055	...	...	−50	...	...
ο Tauri	3 18 21·349	...	·394	...	...	−45	...
f Tauri	3 24 14·890	·921	·930	...	−31	−40	...
ε Eridani	3 27 16·603	·626	·622	·642	−23	−19	−39
11 Tauri	3 33 36·336	·361	...	...	−25	...	...
δ Eridani	3 37 29·996	...	...	·020	...	...	−24
η Tauri	3 40 21 148	·149	·160	...	− 1	−12	...
γ^1 Eridani	3 52 25·847	·887	...	·848	−40	...	−1
A^1 Tauri	3 57 36·109	·144	...	...	−35	...	...
ω^1 Tauri	4 2 10·550	·586	...	...	−36	...	...
o^1 Eridani	4 6 0·437	...	...	·481	...	...	−44
γ Tauri	4 12 57·876	·924	·913	...	−48	−37	...
ε Tauri	4 21 36·570	·619	·626	...	−49	−56	...
Aldebaran	4 29 2·111	·144	·124	...	−33	−13	...
τ Tauri	4 35 2·592	·609	...	...	−17	...	...
μ Eridani	4 39 30·125	...	·138	·146	...	−13	−21
ι Aurigæ	4 49 10 753	·815	·822	...	−62	−69	...
ε Leporis	5 0 22·861	...	...	·890	...	...	−29
Rigel*	5 8 46·253	·267	·256	·218	−14	− 3	(+35)
β Tauri	5 18 42·382	·407	·398	...	−25	−16	...
δ Orionis	5 25 52·519	·577	·554	...	−58	−35	...

* Probably there is a typographic error in (c).

Name of Star.	Right Ascensions for 1880·0. Ten-Year Cat.	(a)	(b)	(c)	App. Corrections. (a)	(b)	(c)
	h m s	s					
α Leporis	5 27 26·260	·272	...	·267	−12	...	− 7
ε Orionis	5 30 7·444	·471	·449	·466	−27	− 5	−22
α Columbæ	5 35 18·225	·286	...	...	−61	...	...
κ Orionis	5 42 3·905	...	·898	·900	...	+ 7	+ 5
α Orionis	5 48 40·505	·516	·504	...	−11	+ 1	...
1 Geminor.	5 56 49·502	·550	...	...	−48	...	...
ν Orionis	6 0 43·184	·271	...	...	−87	...	...
η Geminor.	6 7 38·018	·072	·052	...	−54	−34	...
μ Geminor.	6 15 41·995	·059	·042	...	−64	−47	...
β Canis Maj.	6 17 24·883	...	...	·915	...	...	−32
ν Geminor.	6 21 50·238	·259	...	...	−21	...	...
γ Geminor.	6 30 46·733	·768	·771	...	−35	−38	...
ξ Geminor.	6 38 33·222	...	·242	...	...	−20	...
θ Can. Maj.	6 48 36·824	...	...	·892	...	...	−68
ε Can. Maj.	6 53 54·563	·612	...	...	−49	...	...
ζ Geminor.	6 56 59·424	·496	·476	...	−72	−52	...
γ Can. Maj.	6 58 19·738	...	...	·771	...	...	−33
51 Geminor.	7 6 28·770	·774	...	...	− 4	...	...
δ Geminor.	7 12 57·306	·337	·320	...	−31	−14	...
β Can. Min.	7 20 38·533	...	·564	...	...	−31	...
Castor	7 26 56·497	·542	...	...	−45	...	...
Procyon	7 33 1·109	·185	·139	·107	−76	−30	+ 2
Pollux	7 37 58·265	·298	·289	...	−33	−24	...
ξ Argûs	7 44 14·861	...	...	...	...	...	...
6 Cancri	7 56 8·739	·808	...	...	−69	...	...
15 Argûs	8 2 25·981	·026	...	·025	−45	...	−44
β Cancri	8 10 0·367	...	·402	...	...	−35	...
d^1 Cancri	8 16 29·477	·486	...	...	− 9	...	...
η Cancri	8 25 46·042	·105	...	...	−63	...	...
γ Cancri	8 36 20·411	·420	...	...	− 9	...	...
ε Hydræ	8 40 25·214	·247	·230	...	−33	−16	...
α Cancri	8 51 55·415	·395	·382	...	+20	+33	...
κ Cancri	9 1 14·774	·827	...	...	−53	...	...
83 Cancri	9 12 16·940	·965	...	...	−25	...	...
α Hydræ	9 21 41·398	·433	·432	·410	−35	−34	−12
ξ Leonis	9 25 28·588	·594	...	...	− 6	...	...
o Leonis	9 34 44 690	·709	·725	...	−19	−35	...
ε Leonis	9 39 2·269	·273	·278	...	− 4	− 9	...

Name of Star.	Right Ascensions for 1880·0. Ten-Year Cat.	(a)	(b)	(c)	App. Corrections. (a)	(b)	(c)
	h m s	s					
μ Leonis	9 45 56·170	·211	·206	...	−41	−36	...
π Leonis	9 53 52·267	·282	...	...	−15	...	...
Regulus	10 1 58·798	·818	·804	...	−20	− 6	...
γ^1 Leonis	10 13 21·284	·315	...	...	−31	...	...
μ Hydræ	10 20 17 196	...	...	·234	...	...	−38
ρ Leonis	10 26 29·475	·538	·522	...	−63	−47	...
34 Sextantis	10 36 25·649	·652	...	...	− 3	...	...
l Leonis	10 42 56·905	·956	...	...	−51	...	...
d Leonis	10 54 21·760	·759	...	...	+ 1	...	...
χ Leonis	10 58 49·610	·596	...	...	+14	...	...
δ Leonis	11 7 43·496	·513	·513	...	−17	−17	...
δ Crateris	11 13 20·488	·534	...	·504	−46	...	−16
τ Leonis	11 21 45·949	·952	...	...	− 3	...	...
υ Leonis	11 30 48·259	·290	...	...	−31	...	...
β Leonis	11 42 56·273	·288	·278	...	−15	− 5	...
β Virginis	11 44 26·668	·661	·646	·652	+ 7	+22	+16
π Virginis	11 54 43·388	·392	...	...	− 4	...	...
o Virginis	11 59 5·747	·762	·784	...	−15	−37	...
ϵ Corvi	12 3 57·245	...	...	·288	...	...	−43
η Virginis	12 13 45·967	·015	·996	·996	−48	−29	−29
δ^2 Corvi	12 23 39·354	...	...	·376	...	...	−22
β Corvi	12 28 5·131	·139	...	·126	− 8	...	+ 5
ρ Virginis	12 35 48·629	...	...	...	...	...	...
35 Virginis	12 41 44·799	...	...	...	...	...	...
31 Comæ	12 45 51·153	...	...	...	...	...	...
δ Virginis	12 49 33·524	...	·524	·520	...	0	+ 4
ϵ Virginis	12 56 12·174	...	·208	...	...	−34	...
θ Virginis	13 3 44·247	·242	...	·244	+ 5	...	+ 3
Spica	13 18 52·296	·334	...	·348	−38	...	−52
ζ Virginis	13 28 34·719	·747	·734	·729	−28	−15	−10
m Virginis	13 35 18·844	·889	...	·890	−45	...	−46
τ Bootis	13 41 33·563	...	·594	...	...	−31	...
η Bootis	13 48 58·230	·270	·266	...	...	−36	...
τ Virginis	13 55 32·364	...	·386	·391	...	−22	−27
94 Virginis	13 59 56·570	·533	...	...	+37	...	...
κ Virginis	14 6 29·706	·754	·745	·723	−48	−39	−17
Arcturus	14 10 11·285	·306	·296	...	−21	−11	...
f Bootis	14 20 52·459	...	...	...	...	...	...

Name of Star.	Right Ascensions for 1880·0. Ten-Year Cat.	(a)	(b)	(c)	App. Corrections. (a)	(b)	(c)
	h m s	s					
ρ Bootis	14 26 39·478	·546	·506	...	−68	−28	...
ϵ^2 Bootis	14 39 44·758	·829	...	...	−71	...	...
α Libræ	14 44 14·470	·474	...	·480	− 4	...	−10
ξ^2 Libræ	14 50 15·460	·488	...	·476	−28	...	−16
ψ Bootis	14 59 18·194	...	...	...	...	...	...
ι^1 Libræ	15 5 22·945	...	...	·948	...	...	− 3
β Libræ	15 10 33·010	·041	·038	·028	−31	−28	−18
o^2 Libræ	15 16 20·262	·269	...	...	− 7	...	...
ζ^1 Libræ	15 21 29·407	·422	...	·408	−15	...	− 1
α Coronæ	15 29 36·415	·463	·450	...	−48	−35	...
α Serpentis	15 38 21·424	·473	·462	...	−49	−38	...
ε Serpentis	15 44 50·053	·101	·068	·080	−48	−15	−27
γ Serpentis	15 50 54·622	...	·638	...	...	−16	...
β^1 Scorpii	15 58 27·629	·670	...	·630	−41	...	− 1
δ Ophiuchi	16 8 3·422	·470	·455	·454	−48	−33	−32
γ Herculis	16 16 37·590	...	·590	...	...	0	...
Antares	16 22 3·021	·072	...	·067	−51	...	−46
λ Ophiuchi	16 24 51·671	...	·698	...	...	−27	...
ζ Ophiuchi	16 30 33·074	·116	...	·090	−42	...	−16
ζ Herculis	16 36 45·735	...	·803	...	...	−68	...
κ Ophiuchi	16 51 59·282	·332	·301	...	−50	−19	...
ε Herculis	16 55 41·902	...	·928	...	...	−26	...
η Ophiuchi	17 3 29·781	·789	...	·787	− 8	...	− 6
α^1 Herculis	17 9 10·533	·572	·562	...	−39	−29	..
θ Ophiuchi	17 14 38·432	·433	...	...	− 1	...	...
σ Ophiuchi	17 20 33·631	...	...	...	...	...	...
α Ophiuchi	17 29 21·844	·872	·862	...	−28	−18	...
β Ophiuchi	17 37 32·661	...	·674	·682	...	−13	−21
μ Herculis	17 41 45·700	·777	·774	...	−77	−74	...
89 Herculis	17 50 34·739	...	...	...	...	...	...
72 Ophiuchi	18 1 39·623	...	·633	...	...	−10	...
μ Sagittarii	18 6 35·189	·232	...	·224	−43	...	−35
η Serpentis	18 15 6·023	·053	·030	·052	−30	− 7	−29
λ Sagittarii	18 20 33·875	·892	...	...	−17	...	...
α Lyræ	18 32 52·501	·553	·548	...	−52	−47	...
2 Aquilæ	18 35 42·171	...	...	...	...	...	...
β^2 Lyræ	18 45 38·958	·996	·992	...	−38	−34	...
ε Aquilæ	18 54 10·542	...	·589	...	...	−47	...

Name of Star.	Right Ascensions for 1880·0. Ten-Year Cat.	(a)	(b)	(c)	App. Corrections. (a)	(b)	(c)
	h m s	s					
ζ Aquilæ	18 59 53·667	·696	·676	...	−29	− 9	...
ψ Sagittarii	19 8 10·883	·904	...	...	−21	...	...
ω Aquilæ	19 12 11·008	...	...	...	...	...	...
δ Aquilæ	19 19 26·837	·875	·874	·868	−38	−37	−31
α Vulpec.	19 23 42·712	...	...	...	...	...	...
μ Aquilæ	19 28 13·599	...	...	...	...	...	...
h^2 Sagittarii	19 29 24·222	·218	...	·239	+ 4	...	−17
e^1 Sagittarii	19 33 50·880	·861	...	...	+19	...	...
γ Aquilæ	19 40 33·255	·287	·274	...	−32	−19	...
α Aquilæ	19 44 55·671	·710	·697	...	−39	−26	...
β Aquilæ	19 49 25·072	·131	·114	...	−59	−42	...
c Sagittarii	19 55 16·657	·684	...	...	−27	...	...
θ Aquilæ	20 5 6·752	...	·758	·776	...	− 6	−24
α^2 Capricor.	20 11 23·744	·756	...	·754	−12	...	−10
β Capricor.	20 14 16·093	·105	...	·074	−12	...	+19
ρ Capricor.	20 22 0·859	·909	...	·868	−50	...	− 9
ε Delphini	20 27 28·774	·819	·798	...	−45	−24	...
α Delphini	20 34 3·844	...	·857	...	...	−13	...
ε Aquarii	20 41 10·755	...	·759	·762	...	− 4	− 7
μ Aquarii	20 46 10·808	·853	...	...	−45	...	...
32 Vulpec.	20 49 26·747	...	...	...	...	...	...
θ Capricor.	20 59 11·986	·073	...	...	−87	...	...
ζ Cygni	21 7 49·762	·751	·760	...	+11	+ 2	...
α Equulei	21 9 49·486	...	·496	·498	...	−10	−12
ι Capricor.	21 15 33·817	·819	...	...	− 2	...	...
β Aquarii	21 25 14·435	·479	·470	·466	−44	−35	−31
ξ Aquarii	21 31 21·774	·809	...	...	−35	...	...
ε Pegasi	21 38 17·512	·558	·544	...	−46	−32	...
δ Capricor.	21 40 24·968	·025	...	...	−57	...	...
16 Pegasi	21 47 36·136	...	...	...	...	...	...
α Aquarii	21 59 37·199	·218	·205	·220	−19	− 6	−21
ι Pegasi	22 1 25·506	...	·521	...	...	−15	...
θ Aquarii	22 10 30·035	·056	...	·047	−21	...	−12
γ Aquarii	22 15 27·462	...	·472	·478	...	−10	−16
σ Aquarii	22 24 17·755	·730	...	·762	+25	...	− 7
η Aquarii	22 29 11·366	·394	·387	·390	−28	−21	−24
ζ Pegasi	22 35 28·632	·659	·651	...	−27	−19	...
μ Pegasi	22 44 12·730	...	·746	...	...	−16	...

Name of Star.	Right Ascensions for 1880·0. Ten-Year Cat.	(*a*)	(*b*)	(*c*)	App. Corrections. (*a*)	(*b*)	(*c*)
	h m s	s					
λ Aquarii	22 46 21·205	·240	·204	·208	−35	+ 1	− 3
Fomalhaut	22 51 1·005	·024	...	...	−19	...	...
α Pegasi	22 58 47·025	·048	·032	...	−23	− 7	...
γ Piscium	23 10 56·660	...	·661	·656	...	− 1	+ 4
κ Piscium	23 20 46·842	·852	...	·870	−10	...	−28
ι Piscium	23 33 46·670	·715	·702	·694	−45	−32	−24
δ Sculptor.	23 42 40·401	...	...	...	...	...	...
ω Piscium	23 53 8·938	·990	·966	...	−52	−28	...
2 Ceti	23 57 35·469	...	...	·504	...	...	−35

The systematic differences among the catalogues are shown by taking the mean of the corrections for each quadrant. They are :—

	(*a*)	(*b*)	(*c*)
	s	s	s
Quadrant I.	−·034	−·032	−·022
„ II.	−·030	−·023	−·025
„ III.	−·033	−·027	−·019
„ IV.	−·029	−·019	−·017
Mean	−·032	−·025	−·021

The near approach to equality among the numbers of the first column shows that the periodic difference between (*a*) and the results of Greenwich observations between 1840 and 1870 has been eliminated by the system of 12-hour groups. In the case of the Greenwich Six-Year Catalogue for 1840 the difference was

$$+0^{s}\cdot014\cos\alpha - 0^{s}\cdot034\sin\alpha,$$

and it has continually diminished in the successive catalogues which have since appeared.

Quite remarkable is the large difference of equinoctial point between Greenwich and the other catalogues, which I pointed out in the *Monthly Notices*, vol. xxxv. p. 405, and which has now persisted for about half a century. Its source is probably to be sought not in the absolute declinations of the Sun given by observations, but in the difference between the observed times of transit of the Sun and of the stars. It seems to show an *instrumental* personal equation of a kind not hitherto noticed, and possibly due to differences of thickness of transit threads.

Of the list (*a*) 101 stars belong to the fundamental catalogue of the American Ephemeris. From each of the corrections (*a*)

to these stars the constant $0^s.037$ was subtracted and the mean of the residuals taken, without regard to sign, with the result—

$$\text{Mean } r = \pm 0^s.0145.$$

This corresponds to—

$$\text{Probable difference} = \pm 0^s.012.$$

Had this determination been extended to all the stars in the list the probable difference would doubtless be found larger.

Comparison of the Greenwich Ten-Year Catalogue with the Williamstown Right Ascensions of Polar Stars for 1885. By Professor Truman Henry Safford.

It is pretty sure that the personal equation of an observer varies in some degree with the apparent velocity of the star. Hence different observers will, as a rule, assign different right ascensions to slow-moving stars if they determine them, as is usual, by comparison with quick-moving ones. The investigation of this matter can be facilitated by a study of the right ascensions of high northern stars as given in various catalogues. While we cannot say that the systematic differences near the pole are altogether dependent upon personal equation, we can at least infer that this is partly the case.

The *Greenwich Ten-Year Catalogue* for 1880, just published, contains 106 stars in common with the *Williamstown Catalogue of Polar Right Ascensions* for 1885; and the interval of time between them—on the average no more than three or four years—enables a comparison to be made without much uncertainty, due to proper motion.

Such a comparison I have made, employing Professor Auwers's proper motions as given in the Greenwich Catalogue (except in isolated cases, where other values are decidedly better), or, lacking these, proper motions determined by Argelander or by myself from a least-square discussion of all available material.

The primary object of the comparison, together with many others of the same kind which I have made, has been to obtain the means of deducing final corrections to be applied in perfecting a least-square discussion, which I have nearly completed, of 170 stars within 10° of the North Pole.

The following are the results of the comparison, in zones of convenient width. The Williamstown Catalogue contains no stars south of +65°, and only selected stars between +65° and +80°; but between +80° and the pole is nearly complete as far as the seventh magnitude inclusive:—